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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte YIAO-TEE HSIA[1]
and Lei Li

Appeal 2015-003877
Application 12/167,040
Technology Center 1700

Before CHUNG K. PAK, MARK NAGUMO, and WESLEY B. DERRICK, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Yiao-Tee Hsia and Lei Li ("Seagate") timely appeal under 35 U.S.C. § 134(a) from the Final Rejection[2] of claims 1–7, 10–15, 26–28, 36, and 37.[3] We have jurisdiction. 35 U.S.C. § 6. We reverse.

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[1] The real party in interest is identified as Seagate Technology LLC ("Seagate"). (Appeal Brief, filed 31 July 2014 ("Br."), 3.)

[2] Office action mailed 30 January 2014 ("Final Rejection"; cited as "FR") at 14–15.

[3] Remaining copending claims 29–35 have been withdrawn from consideration by the Examiner (FR 1, § 5a), and are not before us.

OPINION

A. Introduction[4]

The subject matter on appeal relates to methods of making high density magnetic disc drives having patterned media. According to the '040 Specification, the density at which magnetically stored data can be written on conventional continuous media is constrained by the "superparamagnetic limit." (Spec. 1 [0001].)[5] According to the Specification, a solution to this problem is to organize the magnetic media into individual lands. (*Id.*) The resulting topography arising from the regions between the lands, however, is said to induce a deleterious "dynamic response" of a disc head slider flying over the surface. (*Id.* at [0002].)

Seagate seeks patent protection for a method of making a patterned storage medium in which the patterned medium is coated with a polymer, which is then removed selectively, leaving a substantially planer medium. (*Id.* at [0003].) The polymer has a functionalized end group at a first end that preferentially bonds to the recess surfaces. (*Id.*) The recess surfaces must be different from the land surfaces. (*Id.* at 4 [0021].)

Disk drives are generally coated with a lubricant, such as a perfluorinated polyether (PFPE). (*Id.* at 6 [0032].) In preferred

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[4] Application 12/167,040, *Planarization methodology for topographically challenged media surface*, filed 2 July 2008. We refer to the "'040 Specification," which we cite as "Spec."

[5] The "superparamagnetic limit" appears to be the same as the "thermal fluctuation problem" discussed by Hieda '694 (full cite at 5n.10, *infra*) at 1 [0006], in which the magnetization of a sufficiently small particle flips randomly, and the particles lose their stable magnetic order, as discussed by Kamata 1[0005]–[0006] (full cite at 5n.14, *infra*).

embodiments of the invention, the polymer has a functionalized second end that preferentially bonds to the lubricant. (*Id.* at [0023].)

An embodiment of the process is illustrated in Figures 3A–3C, below.

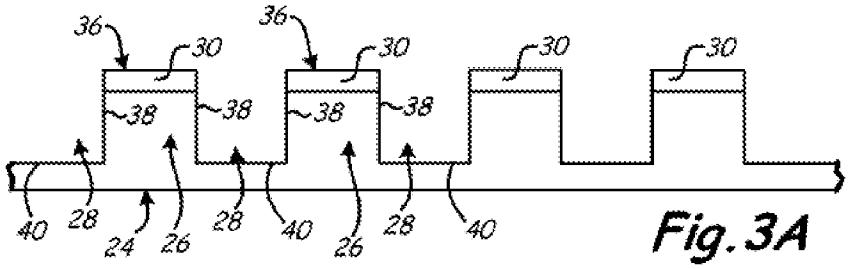

Fig. 3A

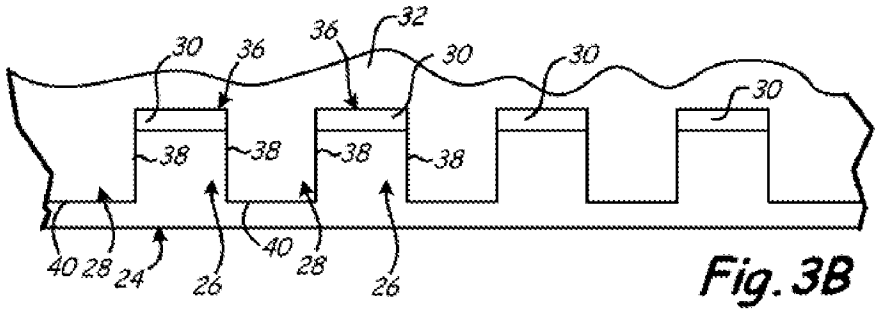

Fig. 3B

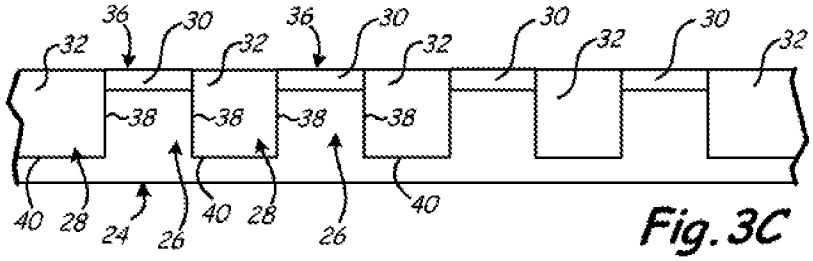

Fig. 3C

{Figs. 3A–3C illustrate the claimed method}

As shown in Fig. 3A, patterned media **24**[6] is provided with lands **26**, made of magnetic material, which have top surfaces **36** and side surfaces **38**. (*Id.* at 3–4 [0019].) Lands **26** may be imprinted or grown on media **24**. (*Id.* at 4 [0020].) Land surfaces **36** may comprise a diamond-like carbon film **30**, which is not present on side surfaces **38** or on recess surfaces **40**. (*Id.* at [0021]–[0022].)

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[6] Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

As shown in Fig. 3B, polymer **32** is applied to the surface of patterned media **24**. (*Id.* at [0023].) In this embodiment, polymer **32** contains polar groups, and the functionalized end groups of polymer **32** are said to facilitate preferential bonding to recess surfaces **40**. (*Id.*) As mentioned *supra*, in a preferred embodiment (*see, e.g.*, claims 4 and 37, Claims App., Br. 27 and 31), the second end of polymer **32** is tailored to preferentially bond to lubricant layer **34**. (*Id.*; see Fig. 2, not reproduced here.) The Specification reveals that polymer **32** may contain self-assembled monolayers ("SAM"), derived, for example, from tridecafluoro-tetrahydrooctyl-trichlorosilane [$CF_3(CF_2)_5$-CH_2CH_2-$SiCl_3$] ("FOTS"). (*Id.* at 5 ll. 6–7.) In this case, following the '040 Specification, it appears that the polar group, $-SiCl_3$, would preferentially bond to the recess surfaces, while the fluorocarbon moiety, $CF_3(CF_2)_5$-, would preferentially bond to the PFPE lubricant.

Claim 1 is representative and reads:

A method comprising:
coating a storage medium with a polymer, wherein
the storage medium comprises
land sides,
land surfaces comprising a first material and
recess surfaces comprising a second material, and
the first material and the second material are different; and
removing the polymer from the land surfaces to form a substantially planar surface on the storage medium, wherein
the polymer comprises
a functionalized end group at a first end that is operable to *preferentially bond* to
the recess surfaces and
the land sides.

(Claims App., Br. 27; some indentation, paragraphing, and emphasis added.)

Remaining independent claim 36 is similar but broader. It does not recite the presence of land sides, and it requires that "the polymer comprises a functionalized end group at a first end *configured to bond to the recess surfaces*." (*Id.* at 30–31; emphasis added.)

The Examiner maintains the following grounds of rejection[7, 8, 9]:

A. Claims 1, 2, 5, 6, 11, and 36 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Hieda '694,[10] Hieda'681,[11] and Dictionary.[12]

B. Claims 1–5, 7–11, 26, 28, 36, and 37 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Hattori,[13] Hieda '681, Dictionary, and Kamata.[14]

Claim 10 is rejected based on Hieda '694, the additional references cited in Rejection A, and Kamata. Similarly, in Rejection B, Kamata is

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[7] Examiner's Answer mailed 2 December 2014 ("Ans.").

[8] Because this application was filed before the 16 March 2013 effective date of the America Invents Act, we refer to the pre-AIA version of the statute.

[9] A rejection under 35 U.S.C. § 112(2), indicated as withdrawn (Pre-Brief Appeal Conference Decision mailed 1 May 2014), appears to have been included in the Examiner's Answer (Ans. 2) by mistake.

[10] Hiroyuki Hieda et al., *Magnetic recording media*, U.S. Patent Application Publication 2006/0257694 A1 (2006).

[11] Hiroyuki Hieda et al., *Pattern forming method and method of processing a structure by use of same*, U.S. Patent Application Publication 2006/0078681 A1 (2006).

[12] Merriam Webster Dictionary, definition of "bond."

[13] Kazuhiro Hattori and Kazuya Shimakawa, *Information medium*, U.S. Patent Application Publication 2007/0275270 A1 (2007), based on an application filed 24 May 2007.

[14] Yoshiyuki Kamata et al., *Magnetic recording medium and method for manufacturing the same*, U.S. Patent Application Publication 2005/0069732 A1 (2005); Hiroyuki Hieda is listed as a co-inventor.

applied against claim 10, but not against independent claims 1 or 36. Claims 6, 12–15, and 27 stand rejected individually view of Hattori and the additional references cited in Rejection B, and six additional references.

As will become apparent, it is not necessary to consider the additional rejections further in view of the additional references to decide this appeal.

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The Examiner finds that principal references Hieda '694 and Hattori describe methods of making planarized patterned magnetic storage media meeting most of the limitations of the claimed method. The Examiner finds that the difference is that Hieda '694 and Hattori fail to teach a polymer having a functionalized end group that preferentially bonds with the recess surfaces. (FR, para. bridging 3–4; 6.)[15] The Examiner finds that Hieda '681 describes such a polymer, namely, a diblock copolymer constituted of blocks A and B, wherein at least one of the blocks (block B) has a mesogen group. The Examiner finds that the mesogen group causes the block "copolymer to self-assemble in the groove to be regularly arrayed." (FR 4, ll. 12–13; 6, ll. 18–19.) This, the Examiner holds, meets the requirement that a functionalized end group preferentially bonds to the recess surfaces

[15] The Examiner finds further that Hattori does not teach that the land surfaces and the recess surfaces comprise different materials (and, as required by claim 10, which depends from claim 1, that the different materials both be magnetic), but finds that Kamata provides these teachings. (*Id.* at 7, l. 10, to 8, l. 4.) As will be become apparent, we need not consider this aspect of the rejection in detail to resolve this appeal.

(*id.* at 4, ll. 13–15; 6, ll. 19–20). The Examiner reasons that the artisan would have been motivated to use the end-functionalized diblock copolymers taught by Hieda '681 in the processes taught by Hieda '694 or Hattori "to maintain consistency in order structures so as to avoid problems in magnetic media [0008], and other benefits (i.e. cost effective) [0006]." (*Id.* at 5, ll. 1–3; 7, ll. 7–9, *citing* Hieda '681.)

Seagate argues, inter alia, that the Examiner has failed to establish an adequate motivation to combine the teachings of principal references Hieda '694 or Hattori with the teachings of Hieda '681. (Br. 13–14 and 19–20 (Hieda '694); 20–21, and 23 (Hattori).) More particularly, Seagate urges, the Examiner has not explained how "consistency in ordered structures" relates to "problems in magnetic media," or what technical nexus is provided by the alleged benefits. (*Id.* at para. bridging 19–20.)

The weight of the evidence supports Seagate's arguments. The Examiner does not direct our attention to any particular problem with the magnetic media disclosed or apparent in Hieda '694 or in Hattori that the regular array of regular phase-separated structures provided by Hieda '681 (*see, e.g.*, Hieda '681, Figs. 5 and 6) would ameliorate. Hieda '681 teaches that these regular phase-separated structures arise from the interaction of the mesogens with the walls of a groove in which the diblock copolymers are placed. (Hieda '681, Fig. 3B and associated text at [0031]–[0033].) The cost and other benefits disclosed by Hieda '681 relate to the subsequent use of those regular arrays of structures to generate high-etching resistant masks from materials such as metals and oxides. (*Id.* at 4 [0034]–[0035], and Example 4 at 5 [0045].) The Examiner has not explained—and we do not perceive any immediately recognizable teachings—that would have

prompted the proposed use of the polymers taught by Hieda '681 as the polymers filling the regions between lands describe by Hieda '694 or by Hattori.

The Examiner makes no findings regarding the secondary references that cure this fundamental defect in the rejection of claim 1.

The rejections of all claims are therefore reversed.

Our reversal of the rejections should not be interpreted as an endorsement of Seagate's arguments (Br. 15–18 and 21–22) regarding the terms "functionalized end group" and "bond." We offer the following observations and comments as guidance in the event of further examination. The '040 Specification does not provide a formal definition of either term, and Seagate has not introduced formal definitions from recognized prior art authority into the record.

More particularly, Seagate has not directed our attention to an unambiguous example of a "functionalized end group" in a polymer. The clearest step in this direction, namely the molecule FOTS, is not a polymer, and the two-dimensional array of a self-assembled monolayer of FOTS does not provide much insight into how a functionalized end group is necessarily defined for the conventional polymers recited in claim 5 (Claims App., Br. 27), especially in the case of polyolefins. The point is not that the resulting term is indefinite, but that it is very broad. The side-chain and main-chain mesogenic diblock copolymers illustrated in Hieda '681, Figures 4A and 4B have mesogens at the end of the B-block that meet any reasonable definition of a "functionalized end-group," in light of the '040 Specification.

Similarly, the term "bond," read in light of the disclosure of the '040 Specification, is very broad. In addition to reactive functional groups such as $-SiCl_3$, the other end of the SAM precursor FOTS, namely the $CF_3(CF_2)_5-$ group, is said to bond preferentially to lubricants such as PFPE. It is well and generally known that these groups are not mutually reactive under ordinary conditions. For example, fluorocarbons like polytetrafluoroethylene, commonly recognized via the TEFLON® registered trademark, are used to provide non-reactive, non-stick surfaces on cookware and other items. Thus, the "preferential bonding" disclosed by the '040 Specification encompasses both conventional chemical bonds as well as much much weaker van der Waals-based interactions.

Given the scope of these terms, Seagate has not demonstrated harmful error in the Examiner's findings that the mesogenic groups provide a "functionalized end group" of a polymer that "is operable to preferentially bond to [] recess surfaces" as required by claim 1. As discussed at length *supra*, the harmful error arises from the absence of a reason to make such a substitution based on the applied prior art.

C. Order

It is ORDERED that the rejection of claims 1–7, 10–15, 26–28, 36, and 37 is reversed.

REVERSED